IS 11159-4 (2011): LUBRICANTS, INDUSTRIAL OILS AND RELATED PRODUCTS (CLASS L) – CLASSIFICATION, Part 4: FAMILY D (COMPRESSORS) [PCD 3: Petroleum, Lubricants and their Related Products]

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स्नेहक, औद्योगिक तेल एवं संबद्ध उत्पाद (श्रेणी एल) — वर्गीकरण

भाग 4 फैमिली डी (संपीडक)

Indian Standard

LUBRICANTS, INDUSTRIAL OILS AND RELATED PRODUCTS (CLASS L) — CLASSIFICATION

PART 4 FAMILY D (COMPRESSORS)

ICS 75:100

BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

August 2011 **Price Group 4**

Petroleum, Lubricants and Their Related Products Sectional Committee, PCD 3

NATIONAL FOREWORD

This Indian Standard (Part 4) which is identical with ISO 6743-3 : 2003 'Lubricants, industrial oils and related products (class L) – Classification — Part 3: Family D (Compressors)' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Petroleum, Lubricants and Their Related Products Sectional Committee and approval of the Petroleum, Coal and Related Products Division Council.

This standard is published in various parts. Other parts in this series are:

Part 1 Class L
Part 2 Family A (Total loss system)
Part 3 Family F (Spindle bearings, bearings and associated clutches)
Part 5 Family H (Hydraulic systems)
Part 6 Family T (Turbines)
Part 7 Family C (Gears)

The text of ISO Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.
b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted in their respective places, are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 3448 : 1992 Industrial liquid lubricants — ISO viscosity classification	IS 9466 : 1980 Viscosity classification of industrial liquid lubricants	Technically Equivalent
ISO 5388 : 1981 Stationary air compressors — Safety rules and code of practice	IS 11461 : 1985 Code of practice for compressor safety	do

The technical committee has reviewed the provision of the following International Standard referred in this adopted standard and has decided that it is acceptable for use in conjunction with this standard:

International Standard	*Title*
ISO 8681 : 1986	Petroleum products and lubricants — Method of classification — Definition of classes

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

LUBRICANTS, INDUSTRIAL OILS AND RELATED PRODUCTS (CLASS L) — CLASSIFICATION

PART 4 FAMILY D (COMPRESSORS)

1 Scope

This part of ISO 6743 establishes the detailed classification of lubricants for use in family D, air compressors, gas compressors and refrigeration compressors.

The intention of this part of ISO 6743 is to provide a rationalized range of the most commonly used internationally available lubricants for air, gas and refrigeration compressors, without resorting to unnecessary restriction by specifications or products description.

The primary intention of this classification is to describe and promote the use of the type of lubricant which is best suited for the particular application, specifically with stationary air compressors, with the aim of reducing as far as possible the risks of fire and explosion. Relevant safety rules are given in ISO 5388.

ISO 5388 as published in 1991 should be revised to reflect the change from light, medium and heavy duty cycles to normal and severe duty cycles as described in this edition of ISO 6743-3.

This part of ISO 6743 should be read in conjunction with ISO 6743-99[1)].

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3448:1992, *Industrial liquid lubricants — ISO viscosity classification*

ISO 5388, *Stationary air compressors — Safety rules and code of practice*

ISO 8681:1986, *Petroleum products and lubricants — Method of classification — Definition of classes*

1) ISO 6743-99:2002, *Lubricants, industrial oils and related products (class L) — Classification — Part 99: General*

3 Explanation of systems used

3.1 The detailed classification of family D has been established by defining the categories of products required for the main applications of this family.

3.2 Each category is designated by a symbol consisting of a group of letters, which together constitute a code.

NOTE The first letter of the code "D" identifies the family of the product considered but the second and third letters taken separately have no significance of their own.

The designation of each category may be supplemented by the addition of viscosity grades according to ISO 3448.

3.3 In this classification system, products are designated in a uniform manner in accordance with ISO 8681. For example, a particular product may be designated in a complete form, e.g., ISO-L-DAB 68, or in an abbreviated form, e.g., L-DAB 68, the number indicating the viscosity grade according to ISO 3448.

Table 1 — Classification of lubricants for air compressors

Code letter	General application	Particular application	More specific application	Product type and/or performance requirements	Symbol ISO-L	Typical applications	Remarks
D	Air compressors	Positive displacement air compressors with oil-lubricated compression chambers	Reciprocating crosshead and trunk pistons or Rotary drip feed (vane)	Normally highly refined mineral oils, may be semi-synthetic or full synthetic fluids	DAA	Normal duty	See Annex A
				Normally specially formulated semi-synthetic or fully synthetic fluids, may be specially formulated highly refined mineral oils	DAB	Severe duty	
			Rotary oil-flooded (vane and screw compressors)	Mineral oils, may be highly refined mineral oils	DAG	Lubricant drain cycles of $\leqslant$ 2 000 h	
				Normally specially formulated highly refined mineral oils or semi-synthetic fluids	DAH	Lubricant drain cycles of $>$ 2 000 h and $\leqslant$ 4 000 h	
				Normally specially formulated semi-synthetic or fully synthetic fluids	DAJ	Lubricant drain cycles of $>$ 4 000 h	
		Positive displacement air compressors with oil-free compression chambers	Liquid-ring compressors and water-flooded vane and screw compressors Reciprocating oil-free compressors Rotary oil-free compressors				Lubricants suitable for gears, bearings and transmissions

Table 1 (*continued*)

Code letter	General application	Particular application	More specific application	Product type and/or performance requirements	Symbol ISO-L	Typical applications	Remarks
		Dynamic compressors	Radial and axial turbo-compressors				Lubricants suitable for bearings and gears
	Vacuum pumps	Positive displacement vacuum pumps with oil-lubricated compression chambers	Reciprocating and rotary drip feed Rotary oil-flooded (vane and screw)		DVA	Low vacuum for non-aggressive gas	Low vacuum is 10^2 to 10^{-1} kPa (10^3 to 1 mbar)
					DVB	Low vacuum for aggressive gas	
			Oil-sealed vacuum pumps (sliding vane, rotary and rotary plunger)		DVC	Medium vacuum for non-aggressive gas	Medium vacuum is 10^{-1} to 10^{-4} kPa (1 to 10^{-3} mbar)
					DVD	Medium vacuum for aggressive gas	
					DVE	High vacuum for non-aggressive gas	High vacuum is 10^{-4} to 10^{-8} kPa (10^{-3} to 10^{-7} mbar)
					DVF	High vacuum for aggressive gas	

Table 2 — Classification of lubricants for process gas compressors

Code letter	General application	Particular application	More specific application	Product type and/or performance requirements	Symbol ISO-L	Typical applications	Remarks
D	Compressors	Positive displacement reciprocating and rotary compressors for all gases Compressors for refrigeration circuits or heat pump circuits, together with air compressors, are excluded	Gases that do not react with highly refined mineral oil or do not lower the viscosity to such an extent that mineral oil cannot be used	Highly refined mineral oils	DGA	N_2, H_2, NH_3, Ar, CO_2 at pressures below 10^4 kPa (100 bar). He, SO_2, H_2S at all pressures. CO at pressures below 10^3 kPa (10 bar)	Ammonia has been found to react with certain additives used in some lubricants
			Gases of DGA type but containing moisture or condensable materials	Special mineral oils	DGB	N_2, H_2, NH_3, Ar, CO_2 at pressures below 10^4 kPa (100 bar)	Ammonia has been found to react with certain additives used in some lubricants
			Gases with high solubility in mineral oil that reduce viscosity	Usually synthetic fluids	DGC [a]	Hydrocarbons at all pressures. NH_3 and CO_2 at pressures above 10^4 kPa (100 bar)	Ammonia has been found to react with certain additives used in some lubricants
			Gases that react chemically with mineral oil	Usually synthetic fluids	DGD [a]	HCl, Cl_2, O_2 and oxygen enriched air at all pressures. CO_2 at pressures above 10^3 kPa (10 bar)	With O_2 and oxygen-enriched air, mineral oils are prohibited and very few synthetic fluids are compatible
			Inert reducing gases that are very dry (dew point − 40 °C)	Usually synthetic fluids	DGE [a]	N_2, H_2, Ar, at pressures below 10^4 kPa (100 bar)	These gases present lubrication difficulties and require special consideration

NOTE Compression of gases at high pressures may cause difficulties (consult the compressor suppliers).

[a] The attention of the user is drawn to the fact that each of the categories DGC, DGD and DGE may, under the same designation, cover products of very different chemical composition that should not be mixed without consulting the suppliers.

Table 3 — Classification of lubricants for refrigeration compressors

Code letter	General application	Refrigerant medium	Lubricant grouping	Particular lubricant type (Typical – Non-inclusive)	Symbol ISO-L	Typical applications	Remarks
D	Compressors, refrigeration systems	Ammonia (NH_3)	Immiscible	Highly refined mineral oil (naphthenic and paraffinic). Alkyl benzene Polyalphaolefin.	DRA	Commercial and industrial refrigeration.	For flooded evaporators with open or semi-hermetic compressors.
			Miscible	Polyalkylene glycol	DRB	Commercial and industrial refrigeration.	For direct expansion evaporators; PAGs for open compressors and factory-built units.
		Hydrofluoro-carbon (HFC)	Immiscible	Highly refined mineral oil (naphthenic/ paraffinic) Alkyl benzene Polyalphaolefin	DRC	Domestic refrigeration. Residential and commercial air-conditioning and heat pump. Bus air-conditioning systems.	Likely in small closed-loop systems.
			Miscible	Polyolester Polyvinylether Polyalkylene glycol	DRD	Mobile air-conditioning. Domestic refrigeration. Residential and commercial air-conditioning and heat pump. Commercial refrigeration including transport refrigeration.	
		Chlorofluoro-carbon (CFC) Hydrochloro-fluorocarbon (HCFC)	Miscible	Highly refined mineral oil (naphthenic and paraffinic) Alkyl Benzene Polyolester Polyvinylether	DRE	Mobile air-conditioning. Domestic refrigeration. Residential and commercial air-conditioning and heat pump. Commercial refrigeration including transport refrigeration.	Chlorine in the refrigerant is beneficial for lubricity.

Table 3 (*continued*)

Code letter	General application	Refrigerant medium	Lubricant grouping	Particular lubricant type (Typical – Non-inclusive)	Symbol ISO-L	Typical applications	Remarks
		Carbon dioxide (CO_2)	Miscible	Highly refined mineral oil (naphthenic and paraffinic). Alkyl benzene Polyalkylene glycol Polyolester Polyvinylether	DRF	Mobile air-conditioning. Residential and commercial air-conditioning and heat pump.	PAG's for open automotive compressors.
		Hydrocarbons (HC)	Miscible	Highly refined mineral oil (naphthenic and paraffinic). Polyalkylene glycol Alkyl benzene Polyalphaolefin Polyolester Polyvinylether	DRG	Industrial refrigeration. Domestic refrigeration. Residential and commercial air-conditioning and heat pump.	Typically factory-built low-charge units.

Table 3 is applicable only to systems where the lubricant is exposed to the refrigerant. Additionally, where the possibility of incidental food contact exists with the lubricant, this lubricant shall comply with the regulations required by each country.

Annex A
(informative)

Information concerning duties of air compressors

A.1 Introduction

The following guidelines are given to help interested parties in differentiating between

— normal duty, and

— severe duty.

A.2 Reciprocating oil-lubricated and rotary drip-feed air compressors

Whether the duty of reciprocating and rotary drip-feed compressors is to be classified as normal or severe (see Table A.1) depends on many parameters, for example:

a) the compressor design, i.e. type of cooling, number of stages, valve velocities, oil retention time, etc.;

b) ambient conditions, i.e. intake air temperature, coolant temperature, presence of catalytic dust or gases, etc.;

c) operating conditions, i.e. continuous or intermittent service, layout of the discharge air piping system, maintenance, oil change intervals, etc.

The ultimate criterion is satisfactory, reliable air compressor operation with the prevention of excessive oil retention or the formation of coke deposits in the hot discharge air piping system.

Table A.1 — Drip-feed oil-lubricated reciprocating and rotary compressors

Duty	Symbol	Duty cycle	Operating conditions		
			Discharge temperature [a]	Differential pressure [b, d]	Discharge pressure [c, d]
Normal [e]	DAA	Intermittent or continuous	$\leqslant$ 165 °C	$\leqslant$ 2,5 MPa	$\leqslant$ 7,0 MPa
Severe [f]	DAB	Intermittent or continuous	$>$ 165 °C	$>$ 2,5 MPa	$>$ 7,0 MPa

[a] Maximum temperature at discharge flange of any cylinder.

[b] Maximum differential pressure between the suction and discharge flanges of any cylinder.

[c] Maximum pressure at discharge flange of any cylinder.

[d] 1 MPa = 10 bar.

[e] Applicable when all criteria are met.

[f] Applicable when any or all criterion is (are met).

A.3 Rotary oil-flooded air compressors

The duty cycle of rotary oil-flooded air compressors (See Table A.2) should be considered severe for all but those applications of continuous or near continuous operation where the air/lubricant temperature does not exceed 100 °C. These compressors commonly start under potentially difficult conditions with the lubricant being highly viscous for run-time conditions of the bearings, air/lubricant separator and/or the circulating lubricant filtration system. Since the lubricant also performs a cooling function, cycling a flooded rotary compressor from no load to partial load to full load conditions can subject the lubricant to elevated shear, thermal and oxidative stresses. Lubricant characteristics such as viscosity, water separation capabilities, compatibility with materials of construction, etc. are required to be of a minimal standard of performance for oil-flooded rotary compressors. However, ageing resistance is considered the definitive property of a lubricant for use in oil-flooded rotary air compressors.

a) the compressor design, i.e., air discharge pressure and pressure ratio, number of stages, oil circulation rate, oil separating system, etc.;

b) ambient conditions, i.e. intake air temperature and humidity, presence of contaminants (dust or gases), etc.;

c) operating conditions, i.e. continuous or intermittent service, maintenance, oil change intervals, discharge temperature, etc.

NOTE Conditions may be such as to recommend an oil for severest operation such as:

a) high relative air humidity ($>$ 80 %);

b) low circulating oil volume;

c) intermittent operation that subjects the lubricant to routine cycling between ambient temperature and $<$ 100 °C, thus promoting the accumulation of condensate in the bulk oil as well as accelerated bearing and rotor wear.

Table A.2 — Rotary oil-flooded air compressors

Drain cycle	Symbol	Duty	Operating conditions [a]
Normal	DAG	Near continuous or continuous	Maximum air/lubricant temperature at the discharge flange of any air end, $\leqslant$ 100 °C
Severe	DAH	Intermittent	Routine cycling of bulk lubricant temperature from ambient to $<$ 100 °C, or maximum air/lubricant temperature at the discharge flange of any air end, $>$ 100 °C
		Continuous	Maximum air/lubricant temperature at the discharge flange of any air end, $>$ 100 °C

[a] In some countries, the maximum air/lubricant discharge temperature may be $<$ 100 °C due to legal restrictions.

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Review of Indian Standards

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